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Evidence of a noon-to-midnight electric field in Saturn's inner magnetosphere, using microsignatures

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Using electron data of the MIMI-LEMMS detector that is onboard the Cassini spacecraft, we have created new, updated catalogues of energetic electron microsignature events caused by the Kronian moons Tethys and Dione. We studied the deviations of the moon's wake from the nearly circular path of the orbit of the moon-absorber and observed significant radial displacements that exhibit systematic asymmetries with respect to the local time, following a systematic trend: inward in the nightside and outward in the dayside of the inner magnetosphere. We show that these asymmetries cannot be explained by asymmetries of the magnetic field in the inner magnetosphere. We developed several methods to associate the properties of the displacements to magnetospheric electric fields. Our results are consistent with an electric field that has a noon-to-midnight orientation and amplitudes that do not exceed 1 mV/m. Such an electric field is not predicted by any theoretical model and its origin is still unknown. While several ongoing studies are in agreement with our result, the radial displacement of microsignatures is the most sensitive tracer of this electric field so we will also discuss how the microsignature dataset can be used to put tighter constraints on its properties and origin.